

REMARKS

Claims 1-4 were originally filed in this application. Claim 1 was previously cancelled without prejudice or disclaimer. Claims 5-12 were previously added. Claims 5, 8, 9, and 12 are currently amended. Support for these amendments is in the specification as originally filed. New claim 13 is currently added. As a result, claims 2-13 stand pending for examination with claims 5, 9, and 12 being independent claims. No new matter has been added.

Rejections Under 35 U.S.C. § 102

Independent claim 12 was rejected under 35 U.S.C. § 102(e) as being anticipated by Bartels et al., U.S. Patent Application Publication No. 2003/0150807 A1 (hereinafter “Bartels.”)

Applicants respectfully disagree that Bartels anticipates the subject matter of independent claim 12.

The Disclosure of Bartels

Bartels is directed to a method of “improving performance of a filtration membrane module comprising a plurality of microporous hollow fibers, the method comprising subjecting the fibers to gas-assisted backwashing, wherein the gas-assisted back-washing removes fouling components from the fibers.” (Bartels at paragraph 0029.) In the filtration module disclosed in Bartels, feed liquid is introduced to the lumen side of fiber membranes. Filtrate is directed through the membranes and collected into a hollow pipe for removal from the module. (Bartels at FIG. 1 and paragraph 0038.) In the gas-assisted backwashing disclosed in Bartels, gas is applied to the membrane lumens, which is the feed side of the membrane. (Bartels at paragraph 0047.)

Bartels relies on the application of gas pressure to the lumens of fiber membranes to expand the membranes in order to “assist[] in dislodging fouling components.” (Bartels at paragraph 0047.) Bartels also relies on a “[r]apid release of the gas pressure” to “provide[] additional force for dislodging fouling components.” (*Id.*)

While applying the gas pressure to the membrane fibers according to the method disclosed by Bartels, the membrane fibers are exposed to gas on both the lumen side and the external side. In paragraph 0047, Bartels states “the gas pressurization should not persist long enough to dry the membrane.” Because the gas pressurization pushes feed out of the lumens of

the membranes, thereby drying them as soon as the gas fills the membrane lumen, the only other part of the membranes that might dry over time are the external walls. The only way the external walls might dry is if they were exposed to a gaseous, rather than a liquid environment.

Independent Claim 12 Patently Distinguishes over Bartels

Independent claim 12 patently distinguishes over Bartels because Bartels fails to teach each and every element of independent claim 12.

Independent claim 12 recites, in pertinent part, “applying a gas at a pressure below a bubble point to a liquid permeate within the hollow fiber membrane immersed in the liquid suspension.” As discussed above, Bartels applies a gas within membranes. This gas drives feed liquid from the membranes. Bartels performs the application of gas in order to remove fouling components, components which had been left on the internal surface of the membrane (i.e. the lumen side) as feed was filtered from within the membrane lumen outward. As recited in independent claim 12, “gas [is applied] at a pressure below a bubble point to a liquid permeate within the hollow fiber membrane.” (emphasis added). A liquid permeate is not feed liquid. Feed liquid is unfiltered liquid. Liquid permeate is liquid that has passed through a membrane wall from a source of feed external to the membrane fiber. Thus, independent claim 12 distinguishes over Bartels because it recites applying a gas at a pressure below a bubble point to a liquid permeate within a fiber membrane, not to a feed liquid.

Even if Bartels could somehow be interpreted as disclosing a filtration method where feed liquid is filtered from the outside of fiber membranes to form permeate on the lumen side of the membranes, an interpretation that Applicants do not believe is reasonable, then fouling materials from the feed liquid would be left on the outside of the fiber membranes, not on the lumen side. In order to accomplish the removal of the fouling materials with a gas applied to the feed side of the membranes, Bartels would then have to apply gas to the outside of the fiber membranes, not to the membrane lumens as recited in independent claim 12.

Further, as discussed above, Bartels applies the gas to the liquid within the membrane when the membrane is exposed to a gaseous external environment, not when the membrane is “immersed in the liquid suspension.” Thus, Bartels cannot teach “applying a gas at a pressure below a bubble point to a liquid permeate within the hollow fiber membrane immersed in the liquid suspension” as recited in independent claim 12.

Because Bartels does not teach each and every element recited in independent claim 12, Bartels cannot anticipate independent claim 12. Accordingly, reconsideration and withdrawal of the rejection of independent claim 12 under 35 U.S.C. § 102 as being anticipated by Bartels is respectfully requested.

Rejections Under 35 U.S.C. § 103

Claims 2-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,202,475 to Selbie et al. (hereinafter “Selbie”) in view of Bartels.

Applicants respectfully disagree that the respective subject matter of each of claims 2-11 would have been obvious over Selbie in view of Bartels.

The Disclosure of Selbie

Selbie is directed to a method of predicting logarithmic reduction values in filtration systems and the use of such values for the control and monitoring of operating filtration systems. (Selbie at Col. 1, lines 6-9.) Selbie discloses a method of testing the integrity of a porous membrane wherein the lumen side of the membrane is the filtrate side. (Selbie at Col. 2, lines 24-29 and at Col. 3, lines 8-16.) Selbie fails to disclose backwashing of a membrane by applying a gas at a pressure below the bubble point to a liquid permeate within the membrane lumen.

Claims 2-11 Patently Distinguish over Selbie in view of Bartels

No *prima facie* case of obviousness of claims 2-11 over Selbie in view of Bartels can be made because the two references cannot be validly combined. Even if the references could have been validly combined, they would fail to teach each and every limitation of claims 2-11.

Independent claim 5 is directed to a method of integrity testing a permeable hollow fiber membrane immersed in a liquid suspension. The method comprises backwashing the membrane by applying a gas at a pressure below a bubble point to a liquid permeate within a membrane lumen subsequent to filtering liquid suspension through the membrane, isolating the lumen of the membrane, measuring a reduction in gas pressure within the lumen of the membrane, and comparing the measured reduction in pressure against a predetermined value.

No *prima facie* case of obviousness of independent claim 5 over Selbie in view of Bartels can be made because the two references cannot be validly combined.

First, as discussed above, Bartels discloses applying gas to a feed liquid within a lumen of a hollow fiber membrane. In contrast, Selbie discloses applying a gas to lumen which is the permeate side of a hollow fiber membrane. One of ordinary skill in the art would not have been motivated to combine Selbie with Bartels because he would have realized that the filtration methods utilized by the apparatus disclosed by Bartels and Selbie are fundamentally different. Selbie discloses an apparatus where liquid is filtered from the outside of a hollow fiber membrane through the membrane and into the hollow fiber membrane lumen, while Bartels discloses filtering liquid feed from inside a hollow fiber lumen outward.

One of ordinary skill in the art also would have realized that an apparatus for filtering a feed liquid from the outside of a hollow fiber membrane through the membrane and into the hollow fiber membrane lumen would require a fundamentally different configuration that would be inoperable for use for filtering liquid feed from inside a hollow fiber lumen outward. Accordingly, Selbie could not be validly combined with Bartels because one of ordinary skill in the art would have realized that no alleged combination could result in an apparatus functional for its intended purpose. For example, one of ordinary skill in the art would not have attempted to combine the disclosure of Selbie with that of Bartels because any alleged resultant combination would have been incapable of providing a permeate backwash. (See Declaration of Warren Thomas Johnson at paragraph 12.)

Second, at the time of invention of the present invention, one of ordinary skill in the art of membrane filtration technology would not have been motivated to combine the membrane integrity testing method disclosed in Selbie with the gas assisted backwashing method disclosed in Bartels because he would have believed that such a combination would have reduced the production rate and production capacity of the membrane filtration system, a result one of ordinary skill in the art of membrane filtration technology and operations would have sought to avoid. This is because one of ordinary skill in the art would have expected that membrane integrity testing would have required a greater amount of operational downtime than backwashing, and that the frequency of membrane integrity testing should thus be kept low, as opposed to backwashing, which is typically performed on a more frequent basis than membrane integrity testing. (See Declaration of Warren Thomas Johnson at paragraph 9.)

Third, Selbie relies on a relatively slow decrease in pressure within the membrane during membrane integrity testing. As stated in Col. 2, lines 7-12 of Selbie, “[i]f the lumens of a fully

wetted membrane (i.e., all the pores are filled with liquid), are filled with air at a pressure below the bubble point, then the pores of the membrane will remain wet and there will be no significant air flow through the pores other than a relatively small flow due to diffusion.” In contrast, as discussed above, Bartels relies on a “[r]apid release of the gas pressure” to “provide[] additional force for dislodging fouling components.” (Bartels at paragraph 0047.) There would have been no motivation for one of ordinary skill in the art to combine the disclosures of Selbie and Bartels because the two references teach methods involving very different modes of operation.

Fourth, as discussed above, Bartels performs a gas backwash with filtration membranes exposed on their external walls to a gaseous environment. In contrast, Selbie discloses a pressure test performed on membranes immersed in a fluid. As disclosed by Selbie, “[i]n the pressure decay test, as with the DAF test, the lumens are first pressurized with air to the test pressure keeping the feed-side of the membrane full.” (Selbie at Col. 3, lines 8-10.) There would have been no motivation for one of ordinary skill in the art to combine the disclosures of Selbie and Bartels because the two references teach methods with fundamentally different modes of operation - gas is applied to the lumens of filtration membranes while the membranes are surrounded by liquid in the disclosure of Selbie while Bartels discloses that gas is applied to the lumens of filtration membranes while the membranes are surrounded by gas.

Even if Selbie and Bartels could have been combined, the resulting combination would fail to teach all of the limitations of independent claim 5. As conceded by the Examiner in the Office Action, Selbie does not disclose a method of backwashing a membrane immersed in a liquid suspension by applying gas below a bubble point to a liquid permeate in a lumen within a membrane as recited in claim 5. However, nothing in Bartels cures the defect of Selbie to teach this element of independent claim 5. Bartels discloses performing the gas backwash upon a liquid feed within lumens of hollow fiber membranes while the membranes are exposed to gas on the outside, not to liquid permeate within the lumens of hollow fiber membranes while they are submerged in a liquid suspension. Thus, Bartels cannot cure the failure of Selbie to teach the method of backwashing as recited in independent claim 5.

One of ordinary skill in the art would not have been motivated to combine the disclosures of Selbie and Bartels for the reasons discussed above. Further, any alleged combination of these references would have lacked at least one explicitly recited claim element in independent claim

5. Thus, no *prima facie* case of obviousness of independent claim 5 can be made based on Selbie in view of Bartels.

Even if a *prima facie* case of obviousness over Selbie in view of Bartels could have been established, the case is rebutted because the invention recited in independent claim 5 solves a long felt but unsolved need. At the time of invention of the present invention, one skilled in the art of membrane filtration technology would have appreciated that there had been a long felt, but unsolved need for avoiding the disadvantages of frequent membrane integrity testing with regard to the reduction in the production rate of a membrane filtration system while still providing for assurance that the filtration membranes were not defective. However, prior to the time of invention of the present invention no one had discovered a way to solve this need. (See Declaration of Warren Thomas Johnson at paragraph 10)

Accordingly, reconsideration and withdrawal of the rejection of claim 5 under 35 U.S.C. § 103 as being unpatentable over Selbie in view of Bartels is respectfully requested.

Dependent claims 2-4 and 6-8 depend from independent claim 5 and are patentable for at least the same reasons as independent claim 5. Accordingly, reconsideration and withdrawal of the rejection of dependent claims 2-4 and 6-8 under 35 U.S.C. § 103 as being unpatentable over Selbie in view of Bartels is respectfully requested.

Independent claim 9 is patentable over Selbie in view of Bartels for at least similar reasons as independent claim 5. As discussed above the two references cannot be validly combined. Further, independent claim 9 recites “backwashing a membrane having a lumen and an external wall by applying a gas at a pressure below a bubble point to a liquid permeate within the lumen of the membrane,” a step not disclosed in either of Selbie or Bartels. As conceded by the Examiner in the Office Action, Selbie does not disclose a method of backwashing a membrane as claimed in claim 9. However, nothing in Bartels cures the defect of Selbie to teach this element of independent claim 9. As discussed above, Bartels discloses performing a gas backwash upon a liquid feed within a lumen of hollow fiber membrane, not to liquid permeate within the lumens of hollow fiber membranes.

Accordingly, reconsideration and withdrawal of the rejection of claim 9 under 35 U.S.C. § 103 as being unpatentable over Selbie in view of Bartels is respectfully requested.

Dependent claims 10 and 11 depend either directly or indirectly from independent claim 9 and are patentable for at least the same reasons as independent claim 9. Accordingly,

reconsideration and withdrawal of the rejection of dependent claims 10 and 11 under 35 U.S.C. § 103 as being unpatentable over Selbie in view of Bartels is respectfully requested.

New Claims

New dependent claim 13 is patentable for at least the same reasons as discussed above.

CONCLUSION

In view of the foregoing Remarks, this application is in condition for allowance; a notice to this effect is respectfully requested. If the Examiner believes that this application is not in condition for allowance, the Examiner is requested to call Applicants' attorney at the telephone number listed below.

If this Response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this Response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 50/2762.

Respectfully submitted,
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